भारतीय मानक
Indian Standard

IS 17546 : 2021

तप्त और अतप्त पेय जल वितरण व्यवस्था के लिए क्लोरीनीकृत पॉलीविनाइल क्लोराइड (सीपीवीसी) फिटिंग — विशिष्टि

Chlorinated Polyvinyl Chloride (CPVC) Fittings For Potable Hot And Cold Water Distribution Supplies — Specification

ICS 23.040.45; 91.140.60

© BIS 2021

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुरशाह ज़फर मार्ग, नई दिल्ली – 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI-110002
www.bis.gov.in www.standardsbis.in

June 2021 **Price Group 7**

Plastic Piping Systems Sectional Committee, CED 50

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Plastic Piping System Sectional Committee had been approved by the Civil Engineering Division Council.

This standard specifies the characteristics of fittings made from chlorinated polyvinyl chloride (CPVC) for piping system intended for jointing to CPVC pipes covered by IS 15778 : 2007 'Chlorinated polyvinyl chloride (CPVC) pipes for potable hot and cold water distribution supplies — Specification'.

In the formulation of IS 15778 : 2007 dealing with CPVC pipes, considerable assistance was derived from the following international standards:

a) ISO 15877-1 : 2009 – 'Plastics piping systems for hot and cold water installations — Chlorinated poly(vinyl chloride) (PVC-C) – Part 1: General',

b) ISO 15877-2 : 2009 – 'Plastics piping systems for hot and cold water installations — Chlorinated poly(vinyl chloride) (PVC-C) – Part 2: Pipes', and

c) ASTM D2846 – 'Standard specification for chlorinated poly (vinyl chloride) (CPVC) plastic hot and cold water distribution systems'.

The sizes of fittings have been kept as per the practice followed by the CPVC pipe manufacturers in the country. All the tests have been covered as per the corresponding ISO standard for the CPVC fittings, that is, ISO 15877 : 3 'Plastic piping system for hot and cold water distribution — Chlorinated poly vinyl chloride (PVC-C) – Part 3 : Fittings'.

In this standard, the dimensions of the fittings have been provided in a manner to meet the requirements of CPVC pipes as given under Table 2 of IS 15778 : 2007.

The standard covers SDR 11 and SDR 17 fittings, however, IS 15778 covers SDR 13.5 pipes also, apart from SDR 11 and SDR 17 pipes. Thus, fittings for SDR 13.5 pipes are not covered in this standard. The SDR 11 fittings can be used for SDR 13.5 pipes as well with higher factor of safety.

This standard does not purport to address all the safety problems associated with its use. It is the responsibility of the users of this standard to establish appropriate safety and health practices and determine the applicability of regulatory safety and health practices and determine the applicability of regulatory limitation prior to use.

Any statutory rules/regulations for phasing out of use of lead stabilizers in PVC plastic pipes and fittings shall be referred and complied to.

The composition of the Committee responsible for formulation of this standard is given in Annex C.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of specified value in this standard.

Indian Standard

CHLORINATED POLYVINYL CHLORIDE (CPVC) FITTINGS FOR POTABLE HOT AND COLD WATER DISTRIBUTION SUPPLIES — SPECIFICATION

1 SCOPE

This standard specifies requirements regarding material, test methods, inspection and marking of injection moulded chlorinated polyvinyl chloride (CPVC) fittings for hot and cold water distribution supplies for water service up to and including 82 °C, intended for connection to CPVC pipes covered by IS 15778. This standard is applicable to fittings of following types:

a) Fittings with solvent cement joints;
b) Mechanical fittings; and
c) Fittings with incorporated inserts.

2 REFERENCES

The standards listed in Annex A contain provisions, which through reference in this text constitute provisions of this standard. At the time of publication the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standard indicated in Annex A.

3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply.

3.1 Nominal Size (*DN*) — The numerical designation for the size of a fitting, other than a fitting designated by thread size, which is a convenient round number approximately equal to the manufacturing dimensions in millimetres.

3.2 Nominal Outside Diameter (d_n) — The specified outside diameter, in millimetres, assigned to a normal size.

3.3 Mean Inside Diameter of Socket at Entry (d_{s1}) — Arithmetic mean of two measured inside diameters perpendicular to each other at the entry of socket.

3.4 Mean Inside Diameter of Socket at Shoulder (Bottom) (d_{s2}) — Arithmetic mean of two measured inside diameters perpendicular to each other at the shoulder (bottom) of socket.

3.5 Out-of-Roundness (Ovality) — Difference between the measured maximum inside diameter and the measured minimum inside diameter in the same cross-sectional plane of a socket.

3.6 Nominal Wall Thickness (e_n) — The numerical designation of the wall thickness of a component, which is a convenient round number approximately equal to the manufacturing dimensions in millimetres.

3.7 Minimum Wall Thickness (e_{min}) — The minimum value of the measurement of the wall thickness at any point around the circumference of the component.

3.8 Tolerance — The permitted variations of the specified value of a quantity, expressed as the difference between the permitted maximum and the permitted minimum values.

3.9 Working Pressure (*PN*) — The numerical designation of a fitting related to the mechanical characteristics of that fitting used for reference purposes.

3.10 Standard Dimension Ratio (*SDR*) — The *SDR* value is the ratio of the nominal outside diameter, d_n, of a pipe to its nominal wall thickness.

$$SDR = \frac{d_n}{e_n}$$

3.11 Tests

3.11.1 *Type Tests* — Tests carried out whenever a change is made in the composition or in the size, in order to establish the suitability and the performance capability of the fitting.

3.11.2 *Acceptance Tests* — Tests carried out on samples taken from a lot for the purpose of acceptance of the lot.

3.12 Virgin Material — Material in such form as granules or powder that has not been subjected to use or processing other than that required for its manufacture and to which no re-processible or recyclable material(s) have been added.

3.13 Own Rework Material — Material prepared from rejected unused fittings, including the runners from the production of fitting, which will be reprocessed in a manufacturer's plant by a process such as injection moulding, and for which the complete formulation is known.

3.14 Fittings for Solvent Cement Joint — Fitting in which the joint with the pipe or another component is made by means of an adhesive.

3.15 Mechanical Fittings

3.15.1 *Compression Fitting* — Fitting in which the joint is made by the compression of a ring or sleeve on the outside wall of the pipe with or without additional sealing elements and with internal support.

3.15.2 *Flanged Fittings* — Fitting in which the pipe connection consists of two mating flanges, which are mechanically pressed together and sealed by the compression of an elastomeric sealing elements between them.

3.15.3 *Flat Seat Union Fitting* — Fitting in which the pipe connection consists primarily of two components, at least one which normally incorporates a flat sealing surface, which are mechanically pressed together by means of a screwed nut or similar and sealed by the compression of an elastomeric sealing element between them.

3.15.4 *Fitting with Incorporated Inserts* — Fitting in which the joint is made by means of connecting threads or other outlets, inserted in the injection-moulded fitting body, combined with at least one solvent cement socket injection-moulded fitting body, combined with at least one solvent socket.

4 NOTATION

The following notation (symbols) shall apply in this standard:

DN = nominal size
d_n = nominal outside diameter
d_{s1} = Inside diameter of the socket at entry (at mouth)
d_{s2} = Inside diameter of the socket at shoulder (at root/bottom)
d_1 = nominal diameter of the socket
d_2 = nominal diameter of the spigot
D = inside diameter at mid-point of socket length
L = socket length
l_0 = free length
r = bending radius
α_n = nominal angle of fitting (total included angle of taper)
e_{ds1} = minimum wall thickness at socket entry
e_{ds2} = minimum wall thickness at socket shoulder (bottom)
e_o = minimum wall thickness overall wall
e_n = nominal wall thickness
PN = nominal pressure (working pressure)
SDR = standard dimension ratio
f_T = de-rating factor for water temperatures
ρ = material density
σ = hydrostatic stress
σ_s = design stress
X = outside diameter

5 CLASSIFICATION OF FITTINGS

The fittings shall be classified on the basis of pressure rating (working pressure) at 27 °C and 82 °C as per Table 1.

Table 1 Classification of Fittings Based on Pressure Rating

(*Clause* 5)

Sl No.	SDR	Size mm (inches)	Working Pressure MPa	
			27 °C	82 °C
(1)	(2)	(3)	(4)	(5)
i)	11	15 to 50 (½" to 2")	2.76	0.68
ii)	17	65 to 150 (2 ½" to 6")	1.73	0.42

NOTE — The above fittings are recommended for water temperature ranging from + 1 to + 82 °C. The recommended maximum safe working stress for these fittings is 13.8 MPa at 27 °C. At higher temperature up to 82 °C, the strength of the fitting reduces and the working pressure shall be modified in accordance with Fig. 1 of IS 15778. Occasional rise in temperature as in summer season with concurrent corresponding reduction temperature during nights has no deleterious effect on the life/working pressure of the fittings considering the total life of fittings.

6 COMPOSITION

6.1 The compound from which the fitting is produced shall consist substantially of chlorinated polyvinyl chloride to which may be added only those additives that are needed to facilitate the manufacture of the fitting and the production of sound and durable fitting of good surface finish, mechanical strength and opacity under conditions of use. None of these additives shall be used separately or together in quantities sufficient to constitute a toxic, organoleptic or microbial growth hazard or materially to impair the fabrication, or to impair the chemical, physical or mechanical properties (in particular long-term mechanical strength and impact strength) as defined in this standard.

6.2 Compound Properties

6.2.1 The chlorinated polyvinyl chloride compound used for the manufacture of fittings shall meet the requirements of Grade G.I.103-2-3-2 of IS 15225. It shall have minimum performance designation, as per **4.2** of IS 15225.

6.2.2 *Compound Chlorine Content*

The chlorinated polyvinyl chloride fittings compounds containing additives such as modifiers, lubricants, fillers, etc, from which the fittings are to be manufactured, shall have chlorine content not less than 55 percent when tested in accordance with Annex B of IS 15778.

6.2.3 The additives to be used for the manufacture of compound shall be selected from IS 10148 and shall be uniformly dispersed.

6.2.4 *Density*

The chlorinated polyvinyl chloride fittings compounds containing additives such as modifiers, lubricants, fillers, etc, from which the fittings are to be manufactured, shall have a density between 1 450 kg/m^3 and 1 650 kg/m^3, when tested in accordance with IS 13360 (Part 3/Sec 10) and IS 13360 (Part 3/Sec 11).

6.2.5 *Verification of the Malfunction Temperature,* T_{mal}

When tested as per the method given in Annex C of IS 15778, at 95 ± 2 °C and a test pressure of 1.0 MPa for 1 000 h, the fittings shall not leak during the prescribed test duration.

6.3 All the rubber parts/rings in plastic to metal fittings which can come in contact with water should be ethylene propylene diene monomer (EPDM) rubber. A test report or conformity certificate for the material may be obtained from the manufacturer of the rubber parts.

7 DIMENSIONS OF FITTINGS

7.1 Diameter

The inside diameter of the socket at entry and the inside diameter of the socket at shoulder (bottom), when measured in accordance with IS 12235 (Part 1) shall be as given in Table 2. The outside diameter of reducer bushing shall be as given in Table 3.

7.2 Wall Thickness

The wall thicknesses of the socket at entry and shoulder, when measured in accordance with IS 12235 (Part 1) shall be as given in Table 2.

7.3 The socket length, ovality of the socket at entry and shoulder, inside diameter at the mid-point of socket length (*D*) and EW, EX and EZ, when measured in accordance with IS 12235 (Part 1) shall be as given in Table 2.

8 PHYSICAL AND CHEMICAL CHARACTERISTICS

8.1 Visual Appearance

The colour of the fitting shall be off-white.

NOTE — Slight variations in the appearance of the colour are permitted.

8.1.1 When viewed without magnification, the internal and external surfaces of fittings shall be smooth, clean and free from scouring, cavities and other surface defects to an extent that would prevent conformance with this standard. The material shall not contain visible impurities.

8.2 Opacity

The wall of the plain fitting shall not transmit more than 0.2 percent of the visible light falling on it when tested in accordance with IS 12235 (Part 3).

8.3 Stress Relief Test

The test specimen shall not show blisters, excessive delamination or cracking or signs of weld line splitting when tested in accordance with IS 12235 (Part 6). The weld line or lines may become pronounced during the test, but this shall not be deemed to constitute failure.

8.4 Vicat Softening Temperature

When tested by the method prescribed in IS 12235 (Part 2), the Vicat softening temperature of the specimen shall not be less than 103 °C.

8.5 Density

When tested in accordance with IS 12235 (Part 14), the density of the fittings shall be between 1 450 kg/m^3 and 1 650 kg/m^3.

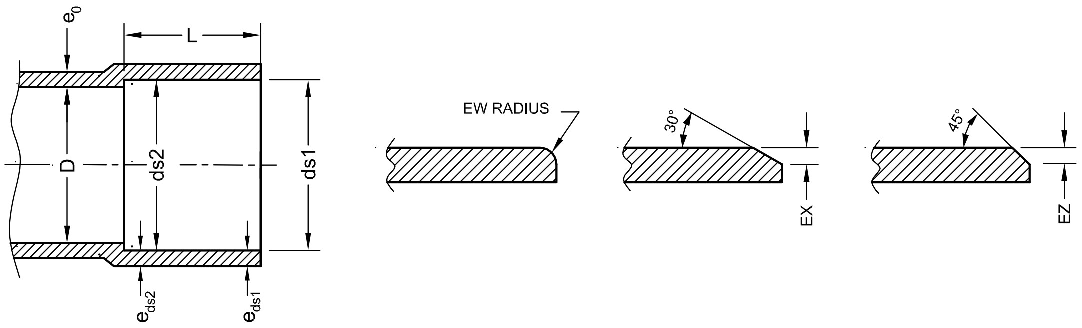
8.6 Effect on Water

The fittings shall not have any detrimental effect on the composition of water flowing through them. The fittings when tested in accordance with the methods given in IS 12235 (Part 4) and IS 12235 (Part 10), the quantities of lead, dialkyl tin C4 and higher homologues (measured as tin), and any other toxic substances extracted from the internal walls of the fittings in the test solution shall not exceed the concentrations as specified in **10.3** of IS 4985, and meet the other requirements given in **10.3.1** of IS 4985.

NOTE — Implementation of the phase out programme for use of lead stabilizers in PVC pipe and fitting manufacturing of Government of India shall be borne in mind.

Table 2 Dimensions of Inside Diameter of the Socket at Entry and Shoulder, Socket Length, Inside Diameter and Wall Thickness

(*Clauses* 7.1, 7.2 *and* 7.3)



Sl No.	Nominal Fitting Size	Inside diameter of the socket at entry d_{s1}			Inside diameter of the socket at shoulder (bottom) d_{s2}			Socket Length, *Min* *L*	Inside Diameter, *Min* *D*	Wall Thickness, *Min*			Entrance, *Min* *EW, EX, EZ*
		Diameter	Tolerance on Nominal Diameter	Maximum Out-of-Roundness	Diameter	Tolerance on Nominal Diameter	Maximum Out-of-Roundness			Socket at Entry e_{ds1}	Socket at Shoulder e_{ds2}	e_o	
	mm (inches)	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
i)	**SDR 11:**												
a)	15 (1/2”)	16.08	± 0.08	0.20	15.72	± 0.08	0.20	12.70	12.42	1.73	2.59	3.25	0.86
b)	20 (3/4”)	22.45	± 0.08	0.26	22.10	± 0.08	0.26	17.78	18.16	2.03	2.59	3.25	0.86
c)	25 (1”)	28.83	± 0.08	0.30	28.47	± 0.08	0.30	22.86	23.39	2.59	2.59	3.25	0.86
d)	32 (1-1/4”)	35.20	± 0.08	0.36	34.85	± 0.08	0.36	27.94	28.58	3.18	3.18	3.96	1.07
e)	40 (1-1/2”)	41.66	± 0.10	0.40	41.20	± 0.10	0.40	33.02	33.76	3.76	3.76	4.70	1.24
f)	50 (2”)	54.38	± 0.10	0.50	53.92	± 0.10	0.50	43.18	44.17	4.90	4.90	6.12	1.63
ii)	**SDR 17:**												
a)	65 (2-1/2”)	73.38	± 0.18	0.76	72.85	± 0.18	0.76	44.45	57.15	6.88	6.88	8.76	EW 2.3, EX, EZ 3.3
b)	80 (3”)	89.31	± 0.20	0.76	88.70	± 0.20	0.76	47.63	71.63	7.47	7.47	9.53	EW 2.3, EX, EZ 3.3
c)	100 (4”)	114.76	± 0.23	0.76	114.07	± 0.23	0.76	57.15	94.92	8.40	8.40	10.67	EW 2.3, EX, EZ 3.3
d)	150 (6”)	168.83	± 0.28	1.52	168.00	± 0.28	1.52	76.20	143.41	10.76	10.76	13.72	EW 3.3,EX, EZ 4.8

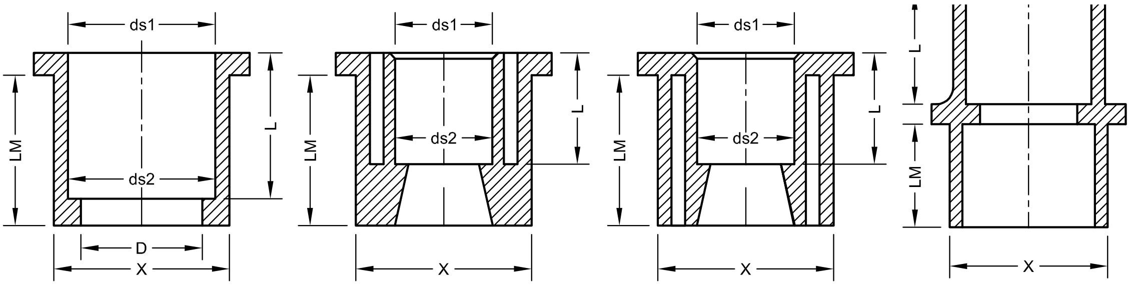
NOTES

1 In plastic to metal fittings, dimensions of sockets at plastic side should be as per this table and dimensions at metal side should be as per manufacturer’s specification.

2 EW, EX and EZ dimensions are only for guideline.

Table 3 Dimensions of Reducer Bushing or Coupling CPVC Socket Type Pipe Fitting

(*Clause* 7.1)

Sl No.	Nominal Size	Outside Diameter, X mm
(1)	(2)	(3)
		
i)	20 mm (3/4”) × 15 mm (1/2”)	22.1 to 22.3
ii)	25 mm (1”) × 15 mm (1/2”), 25 mm (1”) × 20 mm (3/4”)	28.5 to 28.7
iii)	32 mm (1-1/4”) × 15 mm (1/2”), 32 mm (1-1/4”) × 20 mm (3/4”), 32 mm (1-1/4”) × 25 mm (1”)	34.8 to 35.0
iv)	40 mm (1-1/2”) × 15 mm (1/2”), 40 mm (1-1/2”) × 20 mm (3/4”), 40 mm (1-1/2”) × 25 mm (1”), 40 mm (1-1/2”) × 32 mm (1-1/4”)	41.2 to 41.4
v)	50 mm (2”) × 15 mm (1/2”), 50 mm (2”) × 20 mm (3/4”), 50 mm (2”) × 25 mm (1”), 50 mm (2”) × 32 mm (1-1/4”), 50 mm (2”) × 40 mm (1-1/2”)	53.9 to 54.1
vi)	65 mm (2-1/2”) × 32 mm (1-1/4”), 65 mm (2-1/2”) × 40 mm (1-1/2”), 65 mm (2-1/2”) × 50 mm (2”)	72.8 to 73.2
vii)	80 mm (3”) × 50 mm (2”), 80 mm (3”) × 65 mm (2-1/2”)	88.7 to 89.1
viii)	100 mm (4”) × 50 mm (2”), 100 mm (4”) × 65 mm (2-1/2”), 100 mm (4”) × 80 mm (3”)	114.1 to 114.5
ix)	150 mm (6”) × 50 mm (2”), 150 mm (6”) × 65 mm (2-1/2”), 150 mm (6”) × 80 mm (3”), 150 mm (6”) × 100 mm (4”)	168.0 to 168.6

NOTE — Tubing socket dimensions, d_{s1}, d_{s2} and *L*, and tolerances on these dimensions shall be the same as those in Table 2. The minimum length of the male end of the bushing or coupling, *LM*, shall be the same as *L* in Table 2, but in any case the male end shall bottom in the mating fitting. Minimum waterway dimensions, *D* shall be the same as *D* in Table 2.

9 MECHANICAL PROPERTIES

9.1 Hydrostatic Characteristics

When subjected to internal hydrostatic pressure test in accordance with the procedure given in IS 12235 (Part 8/Sec 1), the fitting shall not fail during the prescribed test duration. The temperatures, duration and hydrostatic (hoop) stress for the test shall conform to the requirements given in Table 4. The test shall be carried out not earlier than 24 h after the fittings have been manufactured.

Fittings can be tested either as fitting with mechanical sealed end caps or as an assembly with pipes.

When tested as an assembly, the fittings shall be connected to the corresponding pipe conforming to IS 15778, either by using solvent cement or joined by a mechanical assembly, in such a way that the required hydrostatic test pressure given in Table 4, can be applied. The free length of the solvent-cemented pipe sections shall be chosen according to IS 12235 (Part 8/Sec 1) in such a way that the axial forces caused by the internal pressure are transferred to the fitting.

Before testing, proper cure time has to be provided to the assemblies based on the recommendation of the manufacturer.

9.2 Thermal Stability by Hydrostatic Pressure Testing

When subjected to internal hydrostatic pressure test in accordance with the procedure given in IS 12235 (Part 8/Sec 1), and as per the requirement given in Sl No. (iv) of Table 4, the fitting shall not burst or leak during the prescribed test duration.

Table 4 Requirements for Internal Hydrostatic Pressure Test

(*Clauses* 9.1 *and* 9.2)

Sl No.	Test	Test Temperature °C	Test Period, *Min* h	Test Pressure MPa	
				SDR 11	SDR 17
(1)	(2)	(3)	(4)	(5)	(6)
i)	*Hydrostatic characteristics*:				
	a) Acceptance	27	1	8.62	5.36
	b) Type	95	165	1.12	0.7
	c) Type	95	1 000	0.92	0.57
ii)	*Test for Thermal Stability*				
	d) Type	95	8 760	0.72	0.45

10 SAMPLING AND CRITERIA FOR CONFORMITY

The sampling procedure and criteria for conformity shall be as given in Annex B.

11 MARKING

11.1 Marking elements shall be printed or formed directly on the fitting in such a way that after storage, handling, and installation, legibility is maintained.

NOTE — The manufacturer is not responsible for marking being illegible due to actions such as painting, scratching, covering of the components or by use of detergent, etc, on the components unless agreed or specified by the manufacturer.

11.2 Marking shall not initiate cracks or other types of defects which adversely influence the performance of the fitting. If printing is used, the colouring of the printed information shall differ from the basic colouring of the fitting. The size of the marking shall be such that the marking is legible without magnification.

11.3 The marking on the fittings shall show the following:

a) Manufacturer's name or trade-mark;
b) Nominal fitting size;
c) SDR of fitting; and
d) The word 'CPVC'.

11.3.1 The information regarding batch or lot number, shall be printed on the box or packet containing the fittings.

11.3.1.1 The lot number/batch number shall include the details of production in the following manner:

Year	Month	Day	Machine No.	Shift
xxxx	xx	xx	xxx	x

11.2 BIS Certification Marking

Each fitting conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act,* 2016 and the Rules and Regulations framed thereunder, and the fitting may be marked with the Standard Mark.

ANNEX A

(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
4905 : 2015	Random sampling and randomization procedures (*first revision*)
4985 : 2021	Unplasticized PVC pipes for water supplies — Specification (*fourth revision*)
12235	Thermoplastics pipes and fittings — Methods of test (*first revision*)
(Part 1) : 2004	Measurement of dimensions
(Part 2) : 2004	Determination of vicat softening temperature
(Part 3) : 2004	Test for opacity
(Part 4) : 2004	Determining the detrimental effect on the composition of water
(Part 6) : 2004	Stress relief test
(Part 8/Sec 1) : 2004	Resistance to internal hydrostatic pressure, Section 1 Resistance to internal hydrostatic pressure at constant internal water pressure
(Part 10) : 2004	Determination of organotin as tin aqueous solution
(Part 14) : 2004	Determination of density/relative density (specific gravity)
13360	Plastics — Methods of testing
(Part 3/Sec 10) : 2016	Physical and dimensional properties, Section 10 Determination of density of non-cellular plastics — Immersion method liquid pyknometer method and titration method
(Part 3/Sec 11) : 2016	Physical and dimensional properties, Section 11 Determination of density of non-cellular plastics — Density gradient column method
15225 : 2002	Chlorinated polyvinyl chloride compounds used for pipes and fittings — Specification
15778 : 2007	Chlorinated poly vinyl chloride (CPVC) pipes for potable hot and cold water distribution supplies — Specification
10148 : 1982	Positive list of constituents of polyvinyl chloride (PVC) and its copolymers in contact with foodstuffs, pharmaceuticals and drinking water

ANNEX B

(*Clause* 10)

SAMPLING AND CRITERIA FOR CONFORMITY

B-1 TYPE TESTS

B-1.1 Type tests are intended to prove the suitability and performance of a new composition, or a new compound (say source) or processing techniques or a new design or size of fitting. Such tests, therefore, need to be applied only when a change is made in polymer composition or when a new size of fitting is be introduced.

For the purpose of this standard, type tests shall be carried out as per **B-1.2** to **B-1.8**.

B-1.2 Performance Designation and Chlorine Content

B-1.2.1 For this test, the manufacturer or the supplier shall furnish to the testing authority one sample of the fitting of any size or CPVC compound (whichever is applicable) as mentioned in **6**.

B-1.2.2 The sample so selected shall be tested for compliance with requirements for performance designation as mentioned in **6.2.1** and chlorine content as mentioned in **6.2.2**.

B-1.2.3 If the sample passes the requirements of the test, the designation of the fitting under consideration shall be considered to be eligible for approval, which shall be valid for a period of one year.

B-1.2.4 In case the sample fails in the test, the testing authority, at its discretion, may call for a fresh sample and subject the same to test. If the sample passes the repeat test, the class of fitting under consideration shall be considered eligible for approval. If the sample fails in the repeat test, the type of fitting shall not be approved. The manufacturer or the supplier may be asked to improve the design and resubmit the product for type approval.

B-1.2.5 At the end of the validity period (normally one year) or earlier, if necessary, the testing authority may call for a fresh sample for test for the purpose of type approval.

B-1.3 Opacity

B-1.3.1 For this test, the manufacturer or the supplier shall furnish to the testing authority three samples taken at random from the smallest size and lowest pressure rating of the fitting (that is fitting of thinnest wall section), selected at random preferably from a regular production lot.

B-1.3.2 The samples so selected shall be tested for compliance with requirements for opacity as given in **8.2**.

B-1.3.3 If all three samples pass the requirements of test, the type of the fitting under consideration shall be considered to be eligible for approval, which shall be normally valid for a period of one year.

B-1.3.4 In case any of the samples fails in the test, the testing authority, at its discretion, may call for fresh samples not exceeding the original number, and subject them to the malfunction test. If, in the repeat test, no single failure occurs, the type of fitting under consideration shall be considered eligible for type approval. If any of the samples fails in the repeat test, the type of fitting shall not be approved. The manufacturer or the supplier may be asked to improve the design and resubmit the product for type approval.

B-1.3.5 At the end of the validity period (normally one year) or earlier, if necessary, the testing authority may call for a fresh sample for opacity test for the purpose of type approval.

B-1.4 Verification of Malfunction Temperature, T_{mal}

B-1.4.1 For this test, the manufacturer or the supplier shall furnish to the testing authority one assembly, selected at random preferably from regular production lot.

B-1.4.2 The sample so selected shall be tested for compliance with requirements for malfunction temperature as given in **6.2.5**.

B-1.4.3 If the sample passes the requirements of the test, the type of the fitting under consideration shall be considered to be eligible for approval, which shall be normally valid for a period of three years.

B-1.4.4 In case the sample fails in the test, the testing authority, at its discretion, may call for a fresh sample and subject the same to the malfunction test. If the sample passes the repeat test, the type of fitting under consideration shall be considered eligible for approval. If the sample fails in the repeat test, the type of fitting shall not be approved. The manufacturer or the supplier may be asked to improve the design and resubmit the product for type approval.

B-1.4.5 At the end of the validity period (normally three years) or earlier, if necessary, the testing authority may call for a fresh sample for malfunction test for the purpose of type approval.

B-1.5 Thermal Stability Test (By Internal Hydrostatic Pressure Test)

B-1.5.1 For this test, the manufacturer or the supplier shall furnish to the testing authority three samples of fittings (any size), selected at random preferably from regular production lot.

B-1.5.2 The samples so selected shall be tested for compliance with requirements for thermal stability test as given in **9.2**.

B-1.5.3 If all the three samples pass the requirements of the test, the type of fitting under consideration shall be considered to be eligible for type approval, which shall be normally valid for a period of three years.

B-1.5.4 In case any of the samples fails in this test, the testing authority, at its discretion, may call for fresh samples not exceeding the original number, and subject them to the thermal stability test. If, in the repeat test, no single failure occurs, the type of fitting shall be considered eligible for type approval. If any of the samples fails in the repeat test, the type of fitting shall not be approved. The manufacturer or the supplier may be asked to improve the design and resubmit the product for type approval.

B-1.5.5 At the end of the validity period (normally three years) or earlier, if necessary, the testing authority may call for a fresh sample for thermal stability test for the purpose of type approval.

B-1.6 Internal Hydrostatic Pressure Test (Test Duration 165 h)

B-1.6.1 For this test, the manufacturer or the supplier shall furnish to the testing authority three samples of fittings of same rating and different sizes (including largest and smallest fitting sizes being considered for qualification), selected at random preferably from regular production lot.

B-1.6.2 The samples so selected shall be tested for compliance with requirements for internal hydrostatic pressure test (165 h) as per **9.1** for the test parameters as per Sl No. (i) (b) of Table 4.

B-1.6.3 If all the three samples pass the requirements of the test, the type of fitting under consideration shall be considered to be eligible for type approval, which shall be normally valid for a period of two years.

B-1.6.4 In case any of the samples fails in this test, the testing authority, at its discretion, may call for fresh samples not exceeding the original number, and subject them to the internal hydrostatic pressure test (165 h). If, in the repeat test, no single failure occurs, the type of fitting shall be considered eligible for type approval. If any of the samples fails in the repeat test, the type of fitting shall not be approved. The manufacturer or the supplier may be asked to improve the design and resubmit the product for type approval.

B-1.6.5 At the end of the validity period (normally two years) or earlier, if necessary, the testing authority may call for a fresh sample for thermal stability test for the purpose of type approval.

B-1.7 Internal Hydrostatic Pressure Test (Test Duration 1 000 h)

B-1.7.1 For this test, the manufacturer or the supplier shall furnish to the testing authority three samples of fittings of same rating and different sizes (including largest and smallest fitting sizes being considered for qualification), selected at random preferably from regular production lot.

B-1.7.2 The samples so selected shall be tested for compliance with requirements for internal hydrostatic pressure test (1 000 h) as per **9.1** for the test parameters as per Sl No. (i) (c) of Table 4.

B-1.7.3 If all the three samples pass the requirements of the test, the type of fitting under consideration shall be considered to be eligible for type approval, which shall be normally valid for a period of three years.

B-1.7.4 In case any of the samples fails in this test, the testing authority, at its discretion, may call for fresh samples not exceeding the original number, and subject them to the internal hydrostatic pressure test (1 000 h). If, in the repeat test, no single failure occurs, the type of fitting shall be considered eligible for type approval. If any of the samples fails in the repeat test, the type of fitting shall not be approved. The manufacturer or the supplier may be asked to improve the design and resubmit the product for type approval.

B-1.7.5 At the end of the validity period (normally three years) or earlier, if necessary, the testing authority may call for a fresh sample for thermal stability test for the purpose of type approval.

B-1.8 Test for Effect on Water

B-1.8.1 For this type test, the manufacturer or the supplier shall furnish to the testing authority three samples of the smallest size fitting from each machine selected at random preferably from a regular production lot.

B-1.8.2 The samples so selected shall be tested for compliance with requirements for effect on water test as given in **8.6**.

B-1.8.3 If the sample passes the requirements of the test, the type of the fitting under consideration shall be considered to be eligible for approval, which shall be valid for a period of one year.

B-1.8.4 In case the sample fails in the test, the testing authority, at its discretion, may call for a fresh sample and subject the same to test. If the sample passes the repeat test, the type of fitting under consideration shall be considered eligible for approval. If the sample fails in the repeat test, the type of fitting shall not be approved. The manufacturer or the supplier may be asked to improve the design and resubmit the product for type approval.

B-1.8.5 At the end of the validity period (normally one year) or earlier, if necessary, the testing authority may call for fresh samples for type test for the purpose of type approval.

B-2 ACCEPTANCE TESTS

Acceptance tests are carried out on samples selected from a lot for the purpose of acceptance of the lot.

B-2.1 Lot

In a single consignment, all CPVC fittings of the same size, same pressure rating and same SDR, and fabricated under essentially similar conditions shall be grouped together to constitute a lot.

B-2.2 The conformity of the lot to the requirement of this standard shall be ascertained for each lot separately.

B-2.2.1 These fittings shall be selected from the lot at random. In order to ensure the randomness of selection, procedure given in IS 4905 may be followed.

B-2.3 Number of Test and Criteria for Conformity

Number of tests and criteria for conformity for various tests shall be as given in **B-2.4** to **B-2.8**.

B-2.4 Visual and Dimensional Requirements

B-2.4.1 The number of test samples to be taken from a lot shall depend on the size of the lot and the outside diameter of the fittings, and shall be in accordance with Table 5.

B-2.4.2 These fittings shall be selected at random from the lot and in order to ensure the randomness of selection, a random number table shall be used. For guidance and use of random number tables, IS 4905 may be referred to. In the absence of a random number table, the following procedure may be adopted:

Starting from any fittings in the lot, count them as 1, 2, 3, etc, up to *r* and so on, where *r* is the integral part of *N/n*, *N* being the number of fittings in the lot, and *n* the number of fittings in the sample. Every r^{th} fitting so counted shall be withdrawn so as to constitute the required sample size.

B-2.4.3 The number of fittings given for the first sample in col 4 of Table 5, shall be taken from the lot and examined for visual and dimensional requirements as given in **7** and **8.1** of this standard. A fitting failing to satisfy any of these requirements shall be considered as defective. The lot shall be deemed to have satisfied these requirements, if the number of defectives found in the first sample is less than or equal to the corresponding acceptance number given in col 6 of Table 5. The lot shall be deemed not to have met these requirements, if the number of defectives found in the first sample is greater than or equal to the corresponding rejection number given in col 7 of Table 5. If, however, the number of defectives found in the first sample lies between the corresponding acceptance and rejection numbers given in col 6 and col 7, a second sample of the size given in col 4 shall be taken and examined for these requirements. The lot shall be considered to have satisfied these requirements if the cumulative sample is less than or equal to the corresponding acceptance number given in col 6, otherwise not.

Table 5 Scale of Sampling for Visual Appearance and Dimensional Requirements

(*Clauses* B-2.4.1 *and* B-2.4.3)

Sl No. (1)	Number of Fitting in the Lot (2)	Sample Number (3)	Sample Size (4)	Cumulative Sample (5)	Acceptance Number (6)	Rejection Number (7)
i)	Up to 1 000	First	13	13	0	2
		Second	13	26	1	2
ii)	1 001 to 3 000	First	20	20	0	2
		Second	20	40	1	2
iii)	3 001 to 10 000	First	32	32	0	3
		Second	32	64	3	4
iv)	10 001 and above	First	50	50	1	4
		Second	50	100	4	5

B-2.5 Stress Relief Test

B-2.5.1 The lot, having satisfied visual and dimensional requirements, shall be tested for stress relief test as given in **8.3**.

B-2.5.2 For this purpose, the number of fittings given for the first sample in col 4 of Table 6 shall be taken from the lot. The sample fitting failing the stress relief test shall be considered as defective. The lot shall be deemed to have met the requirements given in this specification for the Stress Relief Test, if the number of defectives found in the first sample is less than or equal to the corresponding acceptance number given in col 6. This lot shall be deemed not to have met these requirements, if the number of defectives found in the first sample is greater than or equal to the corresponding rejection number given in col 7. If, however, the number of defectives in the first sample lies between the corresponding acceptance and rejection numbers given in col 6 and col 7, a second sample of size given in col 4 shall be taken and examined for the requirement. The lot shall be considered to have satisfied the requirements, if the number of defectives found in the cumulative sample is less than or equal to the corresponding acceptance number given in col 6, otherwise not.

B-2.6 Vicat Softening Test

B-2.6.1 The lot, having satisfied visual and dimensional requirements shall be tested for Vicat softening temperature as given in **8.4**.

B-2.6.2 For this purpose, the procedure adopted for sampling and criteria for conformity shall be the same as that for stress relief test under **B-2.5.2** using Table 6.

B-2.7 Density

B-2.7.1 The lot, having satisfied the visual and dimensional requirements, shall be tested for density as given in **8.5**.

B-2.7.2 For this purpose, the procedure adopted for sampling and criteria for conformity shall be the same as that for stress relief test under **B-2.5.2** using Table 6.

B-2.8 Internal Hydrostatic Pressure Test (Short Term - Acceptance Test)

B-2.8.1 The lot, having been found satisfactory according to **B-2.4**, **B-2.5**, **B-2.6** and **B-2.7** shall be subjected to the requirements of the acceptance test for internal hydrostatic pressure as given in **9.1** for test parameters as per Sl No. (i) (a) of Table 4. The number of fittings to be taken from the lot shall depend on the size of the lot and shall be according to Table 7.

B-2.8.2 The fittings shall be taken at random from the lot. In order to ensure the randomness of selection, procedures given in IS 4905 may be followed.

B-2.8.3 The number of test samples shall be as given in Table 7. The lot shall be considered to have satisfied the requirements for this test, if the number of test samples failing in this requirement is equal to the corresponding acceptance number given in col 4 of Table 7.

Table 6 Scale of Sampling for Stress Relief, Vicat Softening Temperature and Density Test

(*Clauses* B-2.5.2, B-2.6.2 *and* B-2.7.2)

Sl No. (1)	Number of Fitting in the Lot (2)	Sample Number (3)	Sample Size (4)	Cumulative Sample Size (5)	Acceptance Number (6)	Rejection Number (7)
i)	Up to 1 000	First	5	5	0	2
		Second	5	10	1	2
ii)	1 001 to 3 000	First	8	8	0	2
		Second	8	16	1	2
iii)	3 001 to 10 000	First	13	13	0	2
		Second	13	26	1	2
iv)	10 001 and above	First	20	20	0	3
		Second	20	40	3	4

Table 7 Scale of Sampling for Internal Hydrostatic Test

(*Clauses* B-2.8.1 *and* B-2.8.3)

Sl No. (1)	Number of Fitting in the Lot (2)	Sample Size (3)	Acceptance Number (4)
i)	Up to 3 000	2	0
ii)	3 001 to 10 000	3	0
iii)	10 001 and above	5	0

ANNEX C

(*Foreword*)

COMMITTEE COMPOSITION

Plastic Piping Systems Sectional Committee, CED 50

Organization	*Representative(s)*
Central Institute of Plastic Engineering and Technology, Chennai	Dr S. K. Nayak (***Chairman***)
Borouge India Pvt Ltd, Mumbai	Shri Prashant D. Nikhade
Brihan Mumbai Licensed Plumbers Association, Mumbai	Shri Kishor V. Merchant Shri Bijal M. Shah (*Alternate*)
Central Institute of Plastic Engineering and Technology, Chennai	Dr S. N. Yadav Shri D. Anjaneya Sharma (*Alternate*)
Central Public Health and Environmental Engineering Organization, New Delhi	Adviser (PHE) Assistant Adviser (PHE) (*Alternate*)
Central Public Works Department, New Delhi	Shri M. K. Sharma Shri Amar Singh (*Alternate*)
Chennai Metropolitan Water Supply & Sewerage Board, Chennai	Engineering Director Superintending Engineer (P & D) (*Alternate*)
CSIR-Central Building Research Institute, Roorkee	Dr B. Singh Shri Rajiv Kumar (*Alternate*)
CSIR-National Environmental Engineering Research Institute, Nagpur	Dr (Shrimati) Abha Sargonkar Dr Ritesh Vijay (*Alternate*)
Delhi Development Authority, New Delhi	Superintending Engineer (D) Executive Engineer (R & D) (*Alternate*)
Delhi Jal Board, New Delhi	Shri Y. K. Sharma Shri S. L. Meena (*Alternate*)
Department of Chemical & Petrochemicals, Govt of India, New Delhi	Joint Industrial Advisor
Finolex Industries Limited, Pune	Shri Arun Sonawane Shri D. J. Salunke (*Alternate*)
GAIL India Limited, New Delhi	Shri Manish Khandelwal Shri Kuldeep Negi (*Alternate* I) Shri Nitin Gupta (*Alternate* II)
Government e-Marketplace, New Delhi	Representative
Haldia Petrochemicals Ltd, Kolkata	Shri Raj K. Datta Shri Amartya Maity (*Alternate*)
HPCL – Mittal Energy Ltd, Noida	Shri Vineet Kumar Gupta Shri Alakesh Ghosh (*Alternate*)
HSIL Ltd (Pipe Divison), Hyderabad	Shri Tushar Lokare Shri Vinoy Kumar (*Alternate*)
Indian Oil Corporation Ltd, Panipat	Shri Dhananjay Sahoo Shri Raja Poddar (*Alternate*)
Jain Irrigation System Limited, Jalgaon	Shri S. Narayanaswami Shri P. H. Chaudhari (*Alternate*)

Organization	*Representative(s)*
Kolkata Municipal Corporation, Kolkata	Shri D. K. Sanyal Shri A. K. Biswas (*Alternate*)
Mahindra EPC Irrigation Ltd, Nashik	Shri Sankar Kumar Maiti Shri C. V. Joshi (*Alternate*)
Military Engineer Services, Engineer-in-Chief's Branch, Integrated HQ of MoD (Army), New Delhi	Shri A. K. Dubey Shri R. K. Chauhan (*Alternate*)
Ministry of Drinking Water and Sanitation, New Delhi	Shri Dinesh Chand Shri Sumit Priyadarshi (*Alternate*)
NSF Safety and Certification India Pvt Ltd, Gurugram	Shri B. B. Singh Shri Nasrin Kashefi (*Alternate*)
Odisha PVC Pipes Manufacturing Association, Bhubaneswar	Shri Nikunj Chhotray
Panchayati Raj and Drinking Water Department, Govt of Odisha, Bhubaneswar	Chief Engineer
Plastindia Foundation, Mumbai	Shri Rajiv J. Raval Dr E. Sundaresan (*Alternate*)
Public Health Engineering Department, Jaipur	Superintending Engineer Executive Engineer (*Alternate*)
Reliance Industries Limited, Mumbai	Shri S. V. Raju Shri Saurabh Baghal (*Alternate*)
RITES Limited, New Delhi	Shri Pankaj Aggarwal Shri Mukesh Sinha (*Alternate*)
Shaktiman Extrusions Pvt Ltd, Perumbavoor	Shri N. Suresh Shri T. S. Manoj (*Alternate*)
Supreme Industries Limited, Jalgaon	Shri G. K. Saxena
Tamil Nadu Water Supply & Drainage Board, Chennai	Engineering Director Joint Chief Engineer (COM) (*Alternate*)
Tata Consulting Engineers Ltd, Mumbai	Representative
In Personal Capacity (*A-59, Sector 35, Noida 201301*)	Shri Kanwar A. Singh
In Personal Capacity (*L-202 Metrozone, Anna Nagar West, Chennai 600040*)	Shri G. K. Srinivasan
BIS Directorate General	Shri Sanjay pant, Scientist 'F' and Head (CED) [Representing Director General (*Ex-officio*)]

Member Secretary

Shrimati Madhurima Madhav
Scientist 'D' (Civil Engineering), BIS

PVC and ABS Piping System Subcommittee, CED 50 : 2

Organization	*Representative(s)*
In Personal Capacity (*L-202, Metrozone, Anna Nagar West, Chennai 600040*)	Shri G. K. Srinivasan (***Convener***)
Ashirvad Pipes Pvt Ltd, Bengaluru	Shri Mohammad Noufal Shri Milind B. Magar (*Alternate*)
Astral Poly Technik Ltd, Ahmedabad	Shri Sandeep Engineer Shri Lalit Trivedi (*Alternate*)
Baerlocher India Additives Pvt Ltd, Mumbai	Dr Shreekant Diwan Shri Sachin Bidkar (*Alternate*)
Central Ground Water Board, Faridabad	Shri D. N. Arun Shri K. R. Biswas (*Alternate*)
Central Institute of Plastic Engineering & Technology, Chennai	Shri M. Navaneethan
Central Public Works Department, New Delhi	Chief Engineer (CSQ) Executive Engineer (S & S) (*Alternate*)
Delhi Jal Board, New Delhi	Shri Y. K. Sharma Shri S. L. Meena (*Alternate*)
Department of Telecommunications Ministry of Communications, Govt of India, New Delhi	Shri V. L. Venkataraman Shri P. Adinarayana (*Alternate*)
Finolex Industries Limited, Pune	Shri Arun Sonawane Shri D. J. Salunke (*Alternate*)
Government E-marketplace, New Delhi	Representative
Jain Irrigation Systems Limited, Jalgaon	Shri Narayanaswami Shri M. R. Kharul (*Alternate*)
Kimplas Piping Systems Ltd, Nashik	Shri Kiran Sarode Shri Santosh Kumar (*Alternate*)
Mahanagar Telephone Nigam Limited, New Delhi	Superintending Engineer (Civil) Shri M. K. Singhal (*Alternate*)
National Test House, Kolkata	Shri D. Sarkar Dr Nishi Srivastava (*Alternate*)
Reliance Industries Limited, Mumbai	Shri S. V. Raju Shrimati Aruna Kumari (*Alternate* I) Shri Jayesh Desai (*Alternate* II)
Rex Polyextrusion Limited, Sangli	Shri Shashank Pargaonkar Shri C. B. Dandekar (*Alternate*)
RITES Limited, New Delhi	Shri Pankaj Aggarwal Shri Mukesh Sinha (*Alternate*)
Rural Water Supply & Sanitation Department, Govt of Orissa, Bhubaneswar	Chief Engineer
Supreme Industries Limited, Jalgaon	Shri G. K. Saxena Shri P. L. Bajaj (*Alternate*)
Tamil Nadu Water Supply & Drainage Board, Chennai	Engineering Director Joint Chief Engineer (Com) (*Alternate*)
In Personal Capacity (*A-59, Sector 35, Noida 201301*)	Shri Kanwar A. Singh

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 2016 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

This Indian Standard has been developed from Doc No.: CED 50 (13682).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

Regional Offices: *Telephones*

Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg
NEW DELHI 110002
2323 7617, 2323 3841

Eastern : 1/14 C.I.T. Scheme VII M, V.I.P. Road, Kankurgachi
KOLKATA 700054
2337 8499, 2337 8561, 2337 8626, 2337 9120

Northern : Plot No. 4-A, Sector 27-B, Madhya Marg
CHANDIGARH 160019
265 0206, 265 0290

Southern : C.I.T. Campus, IV Cross Road, CHENNAI 600113
2254 1216, 2254 1442, 2254 2519, 2254 2315

Western : Manakalaya, E9 MIDC, Marol, Andheri (East)
MUMBAI 400093
2832 9295, 2832 7858, 2832 7891, 2832 7892

Branches : AHMEDABAD. BENGALURU. BHOPAL. BHUBANESHWAR. COIMBATORE. DEHRADUN. DURGAPUR. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. JAMMU. JAMSHEDPUR. KOCHI. LUCKNOW. NAGPUR. PARWANOO. PATNA. PUNE. RAIPUR. RAJKOT. VISAKHAPATNAM.

Published by BIS, New Delhi